

WE CLAIM:

1 1. A method for improving the dispensability of a metering system, said metering system
 2 including at least one dispense nozzle, a fluid supply, and at least one pump fluidly
 3 interconnecting said at least one dispense nozzle and said fluid supply, said pump including a
 4 pump and having a mechanism which produces a variable fluid flow rate profile for a constant
 5 motor speed, said method including the steps of:

6 aspirating fluid from said fluid supply;
 7 dispensing aspirated fluid through said at least one dispense nozzle; and
 8 modifying said variable fluid rate flow profile using said pump motor during at least one
 9 of said aspirating and dispensing steps so as to effect the relative velocity of dispensed fluid.

1 2. A method according to Claim 1, wherein said modifying profile step includes the step
 2 of offsetting a reference position of said pump motor in order to shift at least a portion of said
 3 fluid flow rate profile.

1 3. A method according to Claim 2, wherein said variable speed pump produces a
 2 decrease in motor velocity at the end of said dispensing step, in which said offsetting step offsets
 3 said reference position to cause an increase in fluid dispense velocity at the end of said
 4 dispensing step.

1 4. A method according to Claim 2, wherein said variable speed pump produces a
 2 sinusoidal fluid flow rate profile wherein the fluid flow rate becomes zero at the end of said
 3 dispensing step, wherein said offsetting step is applied to offset the end of said profile to provide
 4 a fluid flow rate at the end of said dispensing step.

1 5. A method according to Claim 4, wherein a predetermined volume of fluid is dispensed
 2 onto a target, said method including the additional step of pre-dispensing residual fluid
 3 remaining from said dispensing step onto one of said target and a separate target prior to a
 4 subsequent aspirating and dispensing step.

1 6. A method according to Claim 5, including the step of increasing the speed of said
2 motor during at least said pre-dispensing step in order to increase the dispense velocity of said
3 fluid.

1 7. A method according to Claim 1, wherein the profile modifying step includes the step
2 of varying the speed of said pump motor to effect said fluid flow rate profile.

1 8. A method according to Claim 7, wherein said profile modifying step includes the step
2 of applying a variation in motor speed according to a profile having a shape which is inverted
3 relative to said fluid flow rate profile.

1 9. A method according to Claim 7, wherein said variable speed pump produces a
2 sinusoidal fluid flow rate profile in which the beginning and end of said dispensing steps
3 produce a fluid flow rate of zero from the dispense nozzle, said modifying step including the step
4 of increasing the speed of the pump motor along portions of said profile in order to increase the
5 fluid flow rate.

1 10. A method according to Claim 7, wherein said variable speed pump produces a
2 sinusoidal fluid flow rate profile, said profile modifying step including the step of applying a
3 variation in motor speed to said pump over said dispensing step which includes a shape which is
4 essentially inverted relative to said fluid flow rate profile to produce a substantially constant
5 dispense velocity during dispensing step.

1 11. A method according to Claim 7, wherein said variable speed pump produces a fluid
2 flow rate profile in which the fluid flow rate during the dispensing step is variable and
3 characterized by an initially low fluid flow rate relative to the remaining portions of said profile,
4 said profile modifying step including the step of increasing the speed of said pump motor during
5 at least the beginning of said dispensing step so as to increase the fluid flow rate sufficiently to
6 prevent perfusion of dispensed fluid.

12. A method for improving the dispensability of a metering system used in a clinical analyzer, said metering system including at least one metering tip, a fluid supply, and at least one pump fluidly interconnecting said at least one metering tip and said fluid supply, said pump including a pump and having a mechanism which produces a variable fluid flow rate profile for a constant motor speed, said method including the steps of:

- a. aspirating fluid from said fluid supply;
- b. dispensing aspirated fluid through said at least one dispense nozzle into a reaction vessel; and
- c. modifying said variable fluid rate flow profile using said pump motor during at least one of said aspirating and dispensing steps so as to effect the relative velocity of dispensed fluid.

13. A method according to Claim 12, wherein said modifying profile step includes the step of offsetting a reference position of said pump motor in order to shift at least a portion of said fluid flow rate profile.

14. A method according to Claim 13, wherein said variable speed pump produces a decrease in motor velocity at the end of said dispensing step, in which said offsetting step offsets said reference position to cause an increase in fluid dispense velocity at the end of said dispensing step.

15. A method according to Claim 13, wherein said variable speed pump produces a sinusoidal fluid flow rate profile wherein the fluid flow rate becomes zero at the end of said dispensing step, wherein said offsetting step is applied to offset the end of said profile to provide a non-zero fluid flow rate at the end of said dispensing step.

16. A method according to Claim 15, wherein a predetermined volume of fluid is dispensed into a first reaction vessel, said method including the additional step of pre-dispensing residual fluid remaining from said dispensing step onto one of said first reaction vessel and a second reaction vessel prior to a subsequent aspirating and dispensing step therein.

1 17. A method according to Claim 16, including the step of increasing the speed of said
2 motor during at least said pre-dispensing step in order to increase the dispense velocity of said
3 fluid.

1 18. A method according to Claim 12, wherein the profile modifying step includes the
2 step of varying the speed of said pump motor to effect said fluid flow rate profile.

1 19. A method according to Claim 18, wherein said profile modifying step includes the
2 step of applying a variation in motor speed according to a profile having a shape which is
3 inverted relative to said fluid flow rate profile.

1 20. A method according to Claim 18, wherein said variable speed pump produces a
2 sinusoidal fluid flow rate profile in which the beginning and end of said dispensing steps
3 produces a fluid flow rate of zero from the metering tip, said modifying step including the step
4 of increasing the speed of the pump motor along portions of said profile in order to increase the
5 fluid flow rate.

1 21. A method according to Claim 18, wherein said variable speed pump produces a
2 sinusoidal fluid flow rate profile, said profile modifying step including the step of applying a
3 variation in motor speed to said pump over said dispensing step which includes a shape which is
4 essentially inverted relative to said fluid flow rate profile to produce a substantially constant
5 dispense velocity during dispensing step.

1 22. A method according to Claim 18, wherein said variable speed pump produces a fluid
2 flow rate profile in which the fluid flow rate during the dispensing step is variable and
3 characterized by an initially low fluid flow rate relative to the remaining portions of said profile,
4 said profile modifying step including the step of increasing the speed of said pump motor during
5 at least the beginning of said dispensing step so as to increase the fluid flow rate sufficiently to
6 prevent perfusion of dispensed fluid relative to said metering tip.

1 23. A metering system comprising:

2 a. at least one dispense nozzle;

3 b. a fluid supply, and

4 c. at least one pump fluidly interconnecting said at least one dispense nozzle and said
5 fluid supply, said pump including a motor and mechanical means for producing a variable fluid
6 flow rate profile for a constant motor speed during at least one phase of a metering cycle
7 including an aspiration phase and a dispensing phase, said system further including means for
8 modifying the fluid rate profile of said pump during at least one phase of said metering cycle so
9 as to effect the relative velocity of dispensed fluid.

1 24. A metering system according to Claim 23, wherein said modifying profile means
2 includes means for offsetting a reference position of said pump motor in order to shift at least a
3 portion of said fluid flow rate profile.

1 25. A metering system according to Claim 24, wherein said variable speed pump
2 produces a decrease in motor velocity at the end of said dispensing step, wherein said reference
3 position can be offset sufficiently to cause a relative increase in fluid dispense velocity at the end
4 of a dispense phase.

1 26. A metering system according to Claim 24, wherein said variable speed pump
2 produces a sinusoidal fluid flow rate profile in which the fluid flow rate becomes zero at the end
3 of a dispense phase, wherein said offsetting means is applied to offset the end of said profile to
4 provide a non-zero fluid flow rate at the end of said dispense phase.

1 27. A metering system according to Claim 26, wherein a predetermined volume of fluid
2 is dispensed into a first target during the dispense phase and in which offsetting causes a residual
3 volume of fluid remaining to complete the dispense phase of the cycle following a dispense
4 phase requiring a pre-dispense phase in which the residual fluid volume is dispensed into one of
5 the first and a separate second target prior to an aspiration phase.

1 28. A metering system according to Claim 27, wherein said profile modifying means
2 includes means for increasing the speed of the pump motor during at least said pre-dispense
3 phase in order to increase the dispense velocity of said fluid.

1 29. A metering system according to Claim 23, wherein the profile modifying means
2 includes means for varying the speed of said pump motor to effect a least a portion of said fluid
3 flow rate profile.

1 30. A metering system according to Claim 29, wherein said profile modifying means
2 includes means for applying a variation in motor speed according to a profile having a shape
3 which is substantially inverted relative to said fluid flow rate profile.

1 31. A metering system according to Claim 29, wherein said variable speed pump
2 produces a sinusoidal fluid flow rate profile in which the beginning and end of said dispensing
3 steps produces a fluid flow rate of zero from the metering tip, said profile modifying means
4 including means for increasing the speed of the pump motor along portions of said flow rate
5 profile in order to increase the fluid flow rate.

1 32. A metering system according to Claim 29, wherein said variable speed pump
2 produces a sinusoidal fluid flow rate profile, said profile modifying means including means for
3 applying a variation in motor speed to said pump during said dispense phase according to a
4 motor speed profile having a shape which is essentially inverted relative to said fluid flow rate
5 profile to produce a substantially constant dispense velocity during dispensing step.

1 33. A metering system according to Claim 29, wherein said variable speed pump
2 produces a fluid flow rate profile in which the fluid flow rate during the dispensing phase is
3 variable and characterized by an initially low fluid flow rate relative to the remaining portions of
4 said profile, said profile modifying means including means for increasing the speed of said pump

5 motor during at least the beginning of said dispensing step so as to increase the fluid flow rate
6 sufficiently to prevent perfusion of dispensed fluid relative to said dispense nozzle.

1 34. A metering system according to Claim 33, wherein said motor speed increasing
2 means is initially applied during the aspiration phase.

1 35. A metering system according to Claim 23, wherein said system is used in a clinical
2 analyzer.

1 36. A clinical analyzer comprising:
2 a metering system, said metering system including:
3 i. at least one dispense nozzle;
4 ii. a fluid supply, and
5 iii. at least one pump fluidly interconnecting said at least one dispense nozzle and said
6 fluid supply, said pump including a motor and mechanical means for producing a variable fluid
7 flow rate profile for a constant motor speed during at least one phase of a metering cycle
8 including an aspiration phase and a dispensing phase,
9 said analyzer further including means for modifying the fluid rate profile of said pump
10 during at least one phase of said metering cycle so as to effect the relative velocity of dispensed
11 fluid.

1 37. A clinical analyzer according to Claim 36, wherein said modifying profile means
2 includes means for offsetting a reference position of said pump motor in order to shift at least a
3 portion of said fluid flow rate profile.

1 38. A clinical analyzer according to Claim 37, wherein said variable speed pump
2 produces a decrease in motor velocity at the end of said dispensing step, wherein said reference
3 position can be offset sufficiently to cause a relative increase in fluid dispense velocity at the end
4 of a dispense phase.

1 39. A clinical analyzer according to Claim 37, wherein said variable speed pump
2 produces a sinusoidal fluid flow rate profile in which the fluid flow rate becomes zero at the end
3 of a dispense phase, wherein said offsetting means is applied to offset the end of said profile to
4 provide a non-zero fluid flow rate at the end of said dispense phase.

1 40. A clinical analyzer according to Claim 39, wherein a predetermined volume of fluid
2 is dispensed into a first target during the dispense phase and in which offsetting causes a residual
3 volume of fluid remaining to complete the dispense phase of the cycle following a dispense
4 phase requiring a pre-dispense phase in which the residual fluid volume is dispensed into one of
5 the first and a separate second target prior to an aspiration phase.

1 41. A clinical analyzer according to Claim 40, wherein said profile modifying means
2 includes means for increasing the speed of the pump motor during at least said pre-dispense
3 phase in order to increase the dispense velocity of said fluid.

1 42. A clinical analyzer according to Claim 36, wherein the profile modifying means
2 includes means for varying the speed of said pump motor to effect at least a portion of said fluid
3 flow rate profile.

1 43. A clinical analyzer according to Claim 42, wherein said profile modifying means
2 includes means for applying a variation in motor speed according to a profile having a shape
3 which is substantially inverted relative to said fluid flow rate profile.

1 44. A clinical analyzer according to Claim 42, wherein said variable speed pump
2 produces a sinusoidal fluid flow rate profile in which the beginning and end of said dispensing
3 steps produces a fluid flow rate of zero from the metering tip, said profile modifying means
4 including means for increasing the speed of the pump motor along portions of said flow rate
5 profile in order to increase the fluid flow rate.

1 45. A clinical analyzer according to Claim 42, wherein said variable speed pump
2 produces a sinusoidal fluid flow rate profile, said profile modifying means including means for
3 applying a variation in motor speed to said pump during said dispense phase according to a
4 motor speed profile having a shape which is essentially inverted relative to said fluid flow rate
5 profile to produce a substantially constant dispense velocity during dispensing step.

1 46. A clinical analyzer according to Claim 42, wherein said variable speed pump
2 produces a fluid flow rate profile in which the fluid flow rate during the dispensing phase is
3 variable and characterized by an initially low fluid flow rate relative to the remaining portions of
4 said profile, said profile modifying means including means for increasing the speed of said pump
5 motor during at least the beginning of said dispensing step so as to increase the fluid flow rate
6 sufficiently to prevent perfusion of dispensed fluid relative to said dispense nozzle.

1 47. A clinical analyzer according to Claim 46, wherein said motor speed increasing
2 means is initially applied during the aspiration phase.

1 48. A method according to Claim 11, wherein said motor increasing step is applied
2 during said aspirating step.

1 49. A method according to Claim 22, wherein said motor speed increasing step is
2 applied during the aspirating step.